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AUTOMATIC CHANGER  
[Oto chenja]

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## Claims

1. An automatic changer characterized by the following facts: the automatic changer has plural accommodating shelves (2) for accommodating plural removable recording media (9), driver (D) that reads said removable recording media (9), and transporter (3) that transports said removable recording media (9) between said accommodating shelves (2) and said driver (D); in this automatic changer, said accommodating shelves (2) and said driver (D) are arranged in sector shape or round shape towards the opening for loading/unloading of said removable recording media (9) at the center; said transporter (3) has the following parts: rotating shaft (41) arranged at the center of said sector shape or round shape, a pair of rotating tables (4) arranged at a certain distance from each other in the axial direction of said rotating shaft (41) and that rotate monolithically around said rotating shaft (41), a pair of rotating shafts (51A), (51B) arranged in a rotatable way between said rotating tables (4), rod shaped guide screw (52), which has threaded portion formed on its peripheral surface and which is arranged in a rotatable way between said two rotating tables (4), guide rail (53) arranged parallel with said guide screw (52) between said two rotating tables (4), nut (52a) engaged to said guide rail (53), engagement part (53a) engaged with said guide rail (53), and holding part (31) that holds said removable recording media (9); there is loading/unloading part (30) for loading/unloading said removable recording media (9); corresponding to the rotation of rotating shaft (51A), said loading/unloading part (30) moves said holding part (31) in the direction perpendicular to the axial direction of said rotating shaft (51A).

2. The automatic changer described in Claim 1, characterized by the following facts: said transporter (3) also has auxiliary loading/unloading part (35) having holding part (36) that holds said removable recording media (9); said auxiliary loading/unloading part (35) is attached on said loading/unloading part (30); corresponding to the rotation of said other rotating shaft (51B), it moves said holding part (36) in the direction perpendicular to the longitudinal direction of said rotating shaft (51B).

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\* [Numbers in right margin indicate pagination of the original text.]

3. The automatic changer described in Claim 2, characterized by the following facts: said pair of rotating shafts (51A), (51B) each have a slot in the axial direction; said loading/unloading part (30) has the following parts: a ring-shaped first gear (51a), which has a protrusion on the inner peripheral surface and engaged in the slot of one rotating shaft (51A) and a gear part on the outer peripheral surface and which can slide on said rotating shaft (51A), intermediate gear (51b) arranged parallel with said first gear (51a) and has two coaxial gear parts, with one gear part engaged with said first gear (51a), crossing gear (51c) arranged in the direction crossing said intermediate gear (51b) and has two coaxial gear parts, with one gear part engaged with the other gear part of said intermediate gear (51b), rod-shaped guide screw (33), which has a threaded portion formed on its peripheral surface and is arranged parallel with said crossing gear (51c) and is engaged to the other gear part of said crossing gear (51c), and nut (33a) screwed on said guide screw (33) and attached on holding part (31) on the side of loading/unloading part (30); said auxiliary loading/unloading part (35) has the following parts: second gear (51e), which has a protrusion on its inner peripheral surface and engaged in the slot of said other rotating shaft (51B) and a gear part on its outer peripheral surface, and which can slide on said rotating shaft (51B), intermediate gear (51f) arranged parallel with said second gear (51e) and has two coaxial gear parts, with one gear part engaged with said second gear (51e), crossing gear (51g) arranged in the direction crossing said intermediate gear (51f) and has two coaxial gear parts with one gear part engaged with the other gear part of intermediate gear (51f), rod shaped guide screw (38) arranged parallel with said crossing gear (51g) and has gear part (51h) engaged with the other gear part of crossing gear (51g), and nut (38a) engaged with guide screw (38) and attached on holding part (36) on the side of auxiliary loading/unloading part (35).

## Detailed explanation of the invention

[0001]

### Technical field of the invention

The present invention pertains to an automatic changer that can accommodate plural removable recording media, such as magnetic tapes, magneto-optical disks, optical disks, etc., and sequentially performs read/write of said recording media.

[0002]

### Prior art

Figure 7 is an oblique view illustrating the overall constitution of automatic changer (11) in the prior art. Figure 8 is a cross-sectional plan view illustrating automatic changer (11) in the prior art. Figure 9 is a plan view illustrating cartridge (19). For example, automatic changer (11) for magneto-optical disks has in the interior of case (11a) plural accommodating shelves (12), (12),... arranged in sector shape. Each accommodating shelf (12) has plural accommodating chambers (120), (120),... in the vertical direction of automatic changer (11) shown in Figure 7, and plural drivers (121), (121),... arranged in the lower portions of said accommodating chambers (120), (120),..., respectively. Each said accommodating chamber (120) and driver (121) have slot-shaped opening portions towards the central side arranged in sector shape. Each accommodating chamber (120) has a magneto-optical disk not shown in the figure fed through the opening portion to be accommodated inside it for each cartridge (19). Each driver (121) performs read/write operation for the magneto-optical disk in cartridge (19) that has been transported from accommodating chamber (120) into it through the opening portion.

[0003]

In the sector shaped central portion where accommodating shelves (12), (12) are arranged, loading/unloading part (13) that performs loading/unloading of cartridge (19) with respect to accommodating chamber (120), and driver (121) and moving part (14) that moves said loading/unloading part (13) are arranged. Also, in case (11a), driving control part (15), which controls moving part (14) and supplies electric power to moving part (14), is arranged. Said moving part (14) and driving control part (15) are connected by means of flat cable (16). Said flat cable (16) has a thin ribbon shape and it is flexible. /3

[0004]

Said moving part (14) is arranged such that it is screwed on guide screw (141) arranged in the vertical direction of case (11a), and, on the other hand, it can move freely in the vertical direction along guide rod (142) arranged together with guide screw (141). As the portion screwed with guide screw (141) is driven to rotate by a motor not shown in the figure, the main body can move in the vertical direction. Also, moving part (14) has a rotating shaft in the vertical direction at said central position of said sector shape. While holding loading/unloading part (13) that rocks freely on said rotating shaft, it can rotate loading/unloading part (13) in the loading/unloading direction.

[0005]

Said loading/unloading part (13) has box shaped case (13a) that takes a horizontal posture as shown in Figures 7 and 8 when the rotation operation around the shaft in said loading/unloading direction by said moving part (14) stops, and case (13a) has a slot shaped opening portion on the side surface facing the opening portions of accommodating chamber (120) and driver (121). Also, inside said case (13a),

box shaped holding part (130) elongating in the width direction of the case is arranged such that it can move freely in said loading/unloading direction. Said holding part (130) is screwed with guide screw (131) arranged in said loading/unloading direction. As the motor not shown in the figure rotates and drives moving part (14), it moves in said loading/unloading direction. Also, said holding part (130) has a pair of hook portions (134), (134) formed protruding to the side facing accommodating chamber (120) and driver (121) on the two end portions in its longitudinal direction. Said hook portions (134), (134) are arranged in the direction facing each other. Between them, cartridge (19) is sandwiched for fetching from case (13a).

[0006]

As shown in Figure 9, cartridge (19) with magneto-optical disk accommodated in it has shutter (191), which is arranged in a freely sliding manner in the direction crossing said loading/unloading direction on one end portion in the loading/unloading direction as shown in Figure 9, and notches (192), (192) arranged on the two end portions in said crossing direction on the other end side. While fetched in holding part (130), the end portion on the side of shutter (191) is arranged facing the opening side of holding part (130).

[0007]

Said loading/unloading part (13) functions as follows: when cartridge (19) that has been fetched in is to be carried into accommodating chamber (120), for said cartridge (19), first, moving part (14) is driven to move in loading/unloading part (13), and it is positioned to face the opening portion of accommodating chamber (120). Then, together with cartridge (19), holding part (130) is driven to move to the side facing accommodating chamber (120) and cartridge (19) is pressed into the opening portion

of accommodating chamber (120), so that the operation for transporting into accommodating chamber (120) is realized.

[0008]

Also, when cartridge (19) is to be transported out from accommodating chamber (120), loading/unloading part (13) functions as follows: guide screw (131) is driven to rotate to change from the state in which loading/unloading part (13) faces the opening portion of accommodating chamber (120) and loading/unloading part (13) is positioned to the state in which holding part (130) without holding cartridge (19) in it is moved to the side facing accommodating chamber (120), and holding part (130) is inserted in accommodating chamber (120), so that cartridge (19) accommodated in accommodating chamber (120) is held. In this holding state, guide screw (131) is driven to rotate in the reverse direction, so that holding part (130) moves out of accommodating chamber (120) and is accommodated in case (13a). As a result, while cartridge (19) is still held, it is accommodated into case (13a).

[0009]

Also, in order to increase the speed in transporting the cartridge, the loading/unloading part has two holding portions. By means of the two holding portions, the automatic changer can transport plural cartridges at the same time.



[0010]

Problems to be solved by the invention

However, the automatic changer in the aforementioned prior art has some problems. The guide screw and the guide rod are directly attached to the case of the automatic changer; the moving part holding said guide screw and guide rod moves up/down along the guide screw and the guide rod so that the loading/unloading part is lifted up/down, and the loading/unloading part is rocked around the rotating shaft in the vertical direction arranged in the moving part. Consequently, the range where the loading/unloading part can rock is restricted to the range where the loading/unloading part does not interfere with the guide screw or the guide rod or the like. For example, the loading/unloading part cannot rock for about one cycle, and thus the position for setting the accommodating shelves is restricted. This is undesirable.

[0011]

Also, in the automatic changer having two holding portions, there is a dedicated loading/unloading part that has two holding portions monolithically assembled. Consequently, it is impossible to take out one holding portion from the loading/unloading part, and it is impossible to add another holding portion to the loading/unloading part that has only one holding portion. This is undesirable.

[0012]

The purpose of the present invention is to solve the aforementioned problems of the prior art by providing an automatic changer characterized by the following facts: a rotating shaft is arranged at the center of the accommodating shelves and driver arranged in sector or round shape; a pair of rotating tables are arranged separated from each other in the axial direction of the rotating shaft; the two rotating

tables can rotate monolithically around said rotating shaft; a loading/unloading part for loading/unloading the removable recording media can move along the guide screw arranged between the two rotating tables; corresponding to rotation of a rotating shaft arranged between the two rotating tables and parallel with said guide screw, the holding portion that holds said recording media can be driven to move in the direction crossing the axial direction of said rotating shaft. As a result, when the rotating tables are rotated, the portions for transporting said recording media, such as the loading/unloading part, guide screw and rotating shaft, etc., can be rotated monolithically, so that rotation of the rotating table is not interfered with, and it is possible to have the loading/unloading part rotate one cycle around said rotating shaft at the center for the automatic changer.

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[0013]

Another purpose of the present invention is to provide an automatic changer characterized by the following facts: an auxiliary loading/unloading part having a holding portion of the recording media is attached on the loading/unloading part; corresponding to rotation of one rotating shaft, the holding portion on the side of the loading/unloading part is driven to move in the direction crossing the axial direction of said rotating shaft; corresponding to rotation of the other rotating shaft, the holding portion on the side of the auxiliary loading/unloading part is driven to move in the direction crossing the axial direction of said rotating shaft. As a result, it is possible to add an auxiliary loading/unloading part to the automatic changer having one loading/unloading part, and it is possible to remove the auxiliary loading/unloading part from the automatic changer having the loading/unloading part and the auxiliary loading/unloading part, so that the automatic changer can perform loading/unloading of the auxiliary loading/unloading part as needed.

[0014]

Another purpose of the present invention is to provide an automatic changer characterized by the following facts: an intermediate gear is arranged at a position where it can be engaged with the first gear or the second gear; by means of rotation of the intermediate gear, the crossing gear and the guide gear are rotated, so that by simply selecting the first gear or the second gear, the loading/unloading part and the adaptive lattice filter are shared, and it is possible to reduce the manufacturing cost.

[0015]

Means to solve the problems

The first invention provides an automatic changer characterized by the following facts: the automatic changer has plural accommodating shelves for accommodating plural removable recording media, a driver that reads said removable recording media, and a transporter that transports said removable recording media between said accommodating shelves and said driver; in this automatic changer, said accommodating shelves and said driver are arranged in sector or round shape towards the opening for loading/unloading of said removable recording media at the center; said transporter has the following parts: a rotating shaft arranged at the position of the center of said sector shape or round shape, a pair of rotating tables arranged at a certain distance from each other in the axial direction of said rotating shaft and which are rotated monolithically around said rotating shaft, a pair of rotating shafts arranged in a rotatable way between said rotating tables, a rod shaped guide screw having a threaded portion formed on its peripheral surface and which is arranged in a rotatable way between said two rotating tables, a guide rail arranged parallel with said guide screw between said two rotating tables, a nut engaged to said guide rail, an engagement part engaged with said guide rail, and a holding part that holds said removable recording media; there is a loading/unloading part for loading/unloading said removable recording

media; corresponding to rotation of the rotating shaft, said loading/unloading part moves said holding part in the direction perpendicular to the axial direction of said rotating shaft.

[0016]

According to the automatic changer in the first invention, due to the effect explained below, it is possible to have the loading/unloading part rotate by about one cycle around the rotating shaft of the rotating table.

[0017]

Figure 10 is a schematic diagram illustrating the operation of the automatic changer in the first invention. The automatic changer in the first invention has a pair of rotating tables (4) attached separated from each other in the axial direction on rotating shaft (41). Between two rotating tables (4), a pair of rotating shafts (51A), (51B), guide screw (52) and guide rail (53) are attached. Said loading/unloading part (30) that performs loading/unloading of the removable recording media is arranged between rotating tables (4) while it goes through rotating shafts (51A), (51B) and guide screw (52). Said nut (52a) screwed on guide screw (52) and engagement part (53a) engaged with guide rail (53) are arranged in loading/unloading part (30). As guide screw (52) is rotated, loading/unloading part (30) is driven to move along guide screw (52), and one rotating shaft (51A) is rotated, so that holding part (31) arranged on loading/unloading part (30) is driven to move in the direction crossing the axial direction of rotating shaft (51A).

[0018]

When rotating tables (4) are rotated around rotating shaft (41), said loading/unloading part (30), rotating shafts (51A), (51B), guide screw (52) and guide rail (53) also are rotated integrated with rotating tables (4), and rotation is not interfered with by guide screw (52) and guide rail (53), etc. Consequently, loading/unloading part (30) can be rotated by about one cycle around rotating shaft (41).

[0019]

The second invention pertains to the automatic changer described in the first invention characterized by the following facts: said transporter also has an auxiliary loading/unloading part having a holding part that holds said removable recording media; said auxiliary loading/unloading part is attached on said loading/unloading part; corresponding to rotation of said other rotating shaft, it moves said holding part in the direction perpendicular to the longitudinal direction of said rotating shaft.

[0020]

In the case of the automatic charger described in the second invention, the auxiliary loading/unloading part having a holding part that holds said recording medium is installed in the loading/unloading part. Corresponding to rotation of one rotary shaft, the holding part on the side of the loading/unloading part moves in the direction crossing with the axial direction of said rotary shaft. Corresponding to the rotation of the other rotary shaft, the holding part on the side of the auxiliary loading/unloading part moves in the direction crossing with the axial direction of said rotary shaft. Consequently, it is possible to add an auxiliary loading/unloading part to an automatic changer having only one loading/unloading part, and it is possible to remove the auxiliary loading/unloading part from

the automatic changer having the loading/unloading part and auxiliary loading/unloading part. As a result, the auxiliary loading/unloading part can be attached/detached as needed.

[0021]

The third invention pertains to the automatic changer described in the second invention characterized by the following facts: said pair of rotating shafts each have a slot in the axial direction; said loading/unloading part has the following parts: a ring-shaped first gear having a protrusion on the inner peripheral surface and engaged in the slot of one rotating shaft and a gear part on the outer peripheral surface and which can slid on said rotating shaft, an intermediate gear arranged parallel with said first gear and has two coaxial gear parts, with one gear part engaged with said first gear, a crossing gear arranged in the direction crossing said intermediate gear and has two coaxial gear parts, with one gear part engaged with the other gear part of said intermediate gear, a rod-shaped guide screw having a threaded portion formed on its peripheral surface and which is arranged parallel with said crossing gear and is engaged to the other gear part of said crossing gear, and a nut screwed on said guide screw and attached on said holding part on the side of said loading/unloading part; said auxiliary loading/unloading part has the following parts: a second gear having a protrusion on its inner peripheral surface and engaged in the slot of said other rotating shaft and a gear part on its outer peripheral surface, and which can slide on said rotating shaft, an intermediate gear arranged parallel with said second gear and has two coaxial gear parts, with one gear part engaged with said second gear, a crossing gear arranged in the direction crossing said intermediate gear and has two coaxial gear parts with one gear part engaged with the other gear part of said intermediate gear, a rod shaped guide screw arranged parallel with said crossing gear and has said gear part engaged with the other gear part of said crossing gear, and a nut

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engaged with said guide screw attached on said holding part on the side of said auxiliary loading/unloading part.

[0022]

For the automatic changer pertaining to the third invention, when one rotating shaft rotates, the first gear of the loading/unloading part with its protrusion engaged with the slot on the rotating shaft is rotated, the intermediate gear with one gear part engaged with the first gear is rotated, the crossing gear with one gear part engaged with the other gear part of the intermediate gear is rotated, the guide screw engaged with the other gear of the crossing gear is rotated, and the holding portion where the nut screwed on the guide screw is attached is driven to move along the guide screw. As a result, the holding portion on the side of the loading/unloading part is driven to move in the direction crossing the axial direction of said rotating shaft.

[0023]

On the other hand, when the other rotating shaft rotates, the second gear of the auxiliary loading/unloading part having a protrusion engaged with the slot of the rotating shaft is rotated, the intermediate gear having one gear part engaged with the second gear is rotated, the crossing gear having one gear part engaged with the other gear part of the intermediate gear is rotated, the guide screw engaged with the other gear of the crossing gear is rotated, and the holding portion where the nut screwed on the guide screw is attached is driven to move along the guide screw. In this way, the holding portion on the auxiliary loading/unloading part is driven to move in the direction crossing the axial direction of said rotating shaft.

[0024]

Consequently, by arranging the intermediate gear at an appropriate position where it can be engaged with either the first gear or the second gear, the loading/unloading part or the auxiliary loading/unloading part can be formed by simply selecting and attaching the first gear or the second gear, many of the members of the loading/unloading part and the auxiliary loading/unloading part can be shared, so that the manufacturing cost can be reduced.

[0025]

#### Embodiment of the invention

In the following, the present invention will be explained in more detail with reference to figures illustrating its embodiment. Figure 1 is an oblique view illustrating the constitution of the main portion of the automatic changer in the present invention. Figure 2 is a cross-sectional plan view illustrating the constitution of the automatic changer in the present invention.

[0026]

As shown in the figure, (1a) represents the case of automatic changer (1). Inside case (1a), there are the following parts: accommodating shelves (2), (2),... for accommodating cartridge (9), drivers (D), (D),... for performing read/write of the optical disk inside cartridge (9), and transporter (3) for transporting said cartridge (9).

[0027]

Each accommodating shelf (2) has plural accommodating chambers (20), (20),... along the vertical direction of automatic changer (1). Said drivers (D), (D),... are attached on the lower portion of



accommodating shelf (2). Said accommodating shelves (2), (2),... are arranged in a round configuration. Each storage chamber (20) and each driver (D) have slot shaped opening portions towards the center of the circle. Each storage chamber (20) has an optical disk not shown in the figure accommodated in it via its opening portion, and each driver (D) performs read/write for the optical disk in cartridge (9) transported from storage chamber (20) and carried into it via the opening portion.

[0028]

Said transporter (3) is arranged in the central portion of the round shaped configuration of accommodating shelves (2), (2),... Said transporter (3) has the following parts: rotating shaft (41) arranged at the center of said round shape and in a state in which it is secured with reference to case (1a), rotating tables (4), (4) attached in a rotatable way on the upper/lower end portions of rotating shaft (41), respectively, and loading/unloading part (30) and auxiliary loading/unloading part (35), which allows loading/unloading of cartridge (9) and which perform loading/unloading of cartridge (9) with respect to storage chamber (20) and driver (D). While arranging above loading/unloading part (30), auxiliary loading/unloading part (35) is secured on loading/unloading part (30), and it moves together with loading/unloading part (30) in the vertical direction. Said rotating tables (4), (4) are plates having the edges bent at a right angle excluding the rotating tip portion, and they are arranged facing each other and are connected by rectangular pipe (42) that has rotating shaft (41) fed through it and has a square shaped cross-section, so that they can rotate monolithically.

[0029]

On the lower surface of upper rotating table (4), a motor not shown in the figure is attached. The rotating shaft of the motor goes through rotating table (4) and protrudes to the upper side. A speed

reducing unit is connected to the rotating shaft of the motor. Said speed reducing unit is connected to the upper end portion of rotating shaft (41) that goes through upper rotating table (4).

[0030]

When the motor rotates, the rotating force of the motor is transmitted via the speed reducing unit to rotating shaft (41). In this case, because rotating shaft (41) is secured on case (1a), under the rotating force of the motor, rotating tables (4), (4) are rotated with respect to rotating shaft (41). Here, integrated with rotating tables (4), (4), loading/unloading part (30) and auxiliary loading/unloading part (35) are rotated.

[0031]

Figure 3 is a side view illustrating the constitution of transporter (3). Figure 4 is a cross-sectional plane view illustrating the constitution of loading/unloading part (30). Figure 5 is a cross-sectional plane view illustrating the constitution of auxiliary loading/unloading part (35). Between rotating tables (4), (4), a pair of rod shaped rotating shafts (51A), (51B) having long slots on their peripheral surfaces in the axial direction and rod shaped guide screw (52) having threaded portion formed on its peripheral surface are attached in a rotatable way with respect to rotating tables (4), (4), respectively. On the lower surface of rotating table (4), by means of a motor and a speed reducing unit consisting of plural pulleys and belts not shown in the figure, said guide screw (52) is rotated with respect to rotating tables (4), (4). Similarly, rotating shafts (51A), (51B) are also rotated individually with respect to rotating tables (4), (4). Also, between rotating tables (4), (4), guide rail (53) with a nearly C-shaped cross-section is arranged parallel with rotating shafts (51A), (51B) and guide screw (52), with its upper end secured on upper rotating table (4) and with its lower end secured on lower rotating table (4).

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[0032]

On loading/unloading part (30), moving part (5) for moving it is arranged. Said moving part (5) consists of first moving part (5a) that moves holding part (31) to be explained later in the carrying in/out direction, and second moving part (5b) that moves loading/unloading part (30) in the vertical direction. Said second moving part (5b) has nut (52a) engaged with guide screw (52), and it has engagement pin (53a) having a disk shaped engagement part at the tip attached on the side portion of first moving part (5a). The engagement part of engagement pin (53a) is engaged with guide rail (53). When guide screw (52) is rotated, engagement pin (53a), which is engaged with guide rail (53), can prevent loading/unloading part (30) from rotating around guide screw (52), so that loading/unloading part (30) can maintain its posture while moving up/down.

[0033]

As shown in Figure 4, first moving part (5a) has box-like gear case (5A) having through holes H1, H2 on the upper/lower sides. Said rotating shaft (51A) goes through said hole H1, and said rotating shaft (51B) goes through said hole H2. Here, first moving part (5a) has first gear (51a) holding rotating shaft (51A) inside gear case (5A). Said first gear (51a) has a protrusion engaged with the slot on rotating shaft (51A) formed on its inner peripheral surface, and it has a gear part formed on its outer peripheral surface. Also, first gear (51a) can slide on rotating shaft (51), so that it does not interfere the up/down movement of loading/unloading part (30). The gear part formed on the outer peripheral surface of first gear (51a) is engaged with intermediate gear (51b). Said intermediate gear (51b) has a gear part engaged with said first gear (51a) in its lower portion, and it has a bevel gear portion in its upper portion. Said bevel gear portion is engaged with the bevel gear portion formed on one end of crossing gear (51c)

arranged with its axial direction in the lateral direction. Said crossing gear (51c) has the other end protruding out of gear case (5A), and it has a gear part arranged on the outer peripheral surface of the protruding portion, and it is engaged with the last gear (51d) arranged parallel with crossing gear (51c) on the outer side of gear case (5A). Said last gear (51d) is connected to guide screw (33), and final gear (d) and guide screw (33) are monolithically rotated.

[0034]

Also, said loading/unloading part (30) has box-like case (32) as shown in Figure 4 on the protruding side of crossing gear (51c) of gear case (5A). Said case (32) has a slit shaped opening portion on the side opposite gear case (5A), that is, on the side surface facing the opening portion of storage chamber (20) and driver (D). Inside case (32), box shaped holding part (31) with its longest edge in the width direction of the holding part is arranged in free movable way in said carrying in/out direction. On the upper side of case (32), guide screw (33) is arranged in said carrying in/out direction, and, on the upper surface of case (32), opening is formed over the entire length of said carrying in/out direction. Also, nut (33a) attached on holding part (31) is screwed on guide screw (33), so that when guide screw (33) is rotated, holding part (31) is driven to move in said carrying in/out direction.

[0035]

In addition, a lock mechanism not shown in the figure is arranged in holding part (31). With the operation of said lock mechanism, it is possible to switch between the operation mode in which guide screw (33) is independently rotated, and the operation mode in which case (32) and guide screw (33) are monolithically rotated. Here, as case (32) and guide screw (33) are monolithically rotated, the entirety of

loading/unloading part (30) is rotated around said carrying in/out direction, and cartridge (9) accommodated in holding part (31) can be inverted.

[0036]

Here, holding part (31) has a pair of hook portions (34), (34) formed protruding towards the side facing storage chamber (20) and driver (D) on the two end portions along its longitudinal direction. Said hook portions (34), (34) are arranged in directions opposite each other, and cartridge (9) that has been fetched into case (32) is held between them.

[0037]

As shown in Figure 3, box-like joining member (6) is attached on the upper surface of first moving part (5a). On the upper surface of said joining member (6), movement part (55) of auxiliary loading/unloading part (35) is attached. As shown in Figure 5, said movement part (55) has an appropriate shape corresponding to the removal of second moving part (5b) from moving part (5) of loading/unloading part (30). Said movement part (55) has gear case (55A) with two holes H3, H4 formed on it. Just as gear case (5A), said gear case (55A) has rotating shaft (51A) fed through hole H3, and has rotating shaft (51B) fed through hole H4. Inside gear case (55A), there is second gear (51e) that holds rotating shaft (51B). Also, on movement part (55), intermediate gear (51f), crossing gear (51g), and last gear (51h) are attached in the same configuration as that of said intermediate gear (51b), crossing gear (51c) and last gear (51d) of first moving part (5a). Said second gear (51e) is engaged with the gear part on the lower side of intermediate gear (51f).

[0038]

Just as loading/unloading part (30), on the protruding side of crossing gear (51g) of gear case (55A), case (37) is arranged. Inside said case (37), holding part (36) is attached in the same state as holding part (31) of loading/unloading part (30). Here, guide screw (38) connected to said last gear (51g) [sic] is arranged on the upper side of case (37). As guide screw (38) is rotated, together with nut (38a) screwed on guide screw (38), holding part (36) is driven to move in the carrying in/out direction. /7

[0039]

Similar to holding part (31), holding part (36) also has a pair of hook portions (39), (39) at the two end portions, and it can hold cartridge (9) between said hook portions.

[0040]

Figure 6 is a plan view illustrating the constitution of cartridge (9). Here, as shown in Figure 6, cartridge (9) having optical disk accommodated in it has shutter (91) that is arranged in a freely sliding manner in the direction crossing said carrying in/out direction at one end portion in said carrying in/out direction, and notches (92), (92) at the two end portions of the other end side in said crossing direction. While accommodated inside holding parts (31), (36), the end portion on the side of shutter (91) is arranged towards the opening side of holding parts (31), (36).

[0041]

For loading/unloading part (30) and auxiliary loading/unloading part (35), when the state is changed from cartridge (9) being accommodated inside to the state in which cartridge (9) is transported into storage chamber (20), first, rotating tables (4), (4) are driven to rotate around rotating shaft (41),

loading/unloading part (30) and auxiliary loading/unloading part (35) are monolithically rotated with rotating tables (4), (4), so that loading/unloading part (30) and auxiliary loading/unloading part (35) are driven to move up/down, and the opening portion of loading/unloading part (30) or auxiliary loading/unloading part (35) is positioned facing the opening portion of storage chamber (20). Here, for loading/unloading part (30), as rotating shaft (51A) is rotated, guide screw (33) is rotated, and together with cartridge (9), holding part (31) is driven to move to the side facing storage chamber (20), and cartridge (9) is pressed into the opening portion of storage chamber (20), so that the operation for carrying into storage chamber (20) by loading/unloading part (30) is realized.

[0042]

On the other hand, for auxiliary loading/unloading part (35), as rotating shaft (51B) rotates, guide screw (38) is rotated, holding part (36) is driven to move together with cartridge (9) towards the side facing storage chamber (20), and cartridge (9) is pressed into the opening of storage chamber (20), so that the transporting operation by auxiliary loading/unloading part (35) into storage chamber (20) is realized.

[0043]

Also, for loading/unloading part (30), when cartridge (9) is transported out of storage chamber (20), rotating shaft (51A) is rotated from the state in which loading/unloading part (30) is positioned to the state in which the opening of loading/unloading part (30) faces the opening of storage chamber (20), so that guide screw (33) is rotated, and storage chamber (20) without cartridge (9) held in it is driven to move to the side facing storage chamber (20), and holding part (31) is inserted into storage chamber (20). As a result, cartridge (9) accommodated in storage chamber (20) is held in holding part (31). In this

holding state, rotating shaft (51A) is rotated in the opposite direction, and guide screw (33) is rotated in the opposite direction. As a result, holding part (31) is moved out of storage chamber (20) and it is accommodated in case (32), and thus cartridge (9) is fetched into case (32) while being held.

[0044]

Similarly, for auxiliary loading/unloading part (35), when cartridge (9) is transported out of storage chamber (20), rotating shaft (51B) is rotated from the state in which auxiliary loading/unloading part (35) is positioned at the position facing the opening of storage chamber (20), so that guide screw (38) is rotated, and while cartridge (9) is not held, holding part (36) is driven to move to the side facing storage chamber (20), and holding part (36) is inserted into storage chamber (20). As a result, cartridge (9) accommodated in storage chamber (20) is held in holding part (36). In this holding state, rotating shaft (51B) is rotated in the opposite direction, and guide screw (38) is rotated in the opposite direction. As a result, holding part (36) is moved into case (37), and thus cartridge (9) is fetched into case (37) while being held.

[0045]

For the aforementioned constitution, when loading/unloading part (30) and auxiliary loading/unloading part (35) are driven to rotate around rotating shaft (41), the entirety of transporter (3) is rotated around rotating shaft (41), so that rotating shaft (51) and guide screw (52) and other members for moving loading/unloading part (30) and auxiliary loading/unloading part (35) up/down do not interfere with the rotation of loading/unloading part (30) and auxiliary loading/unloading part (35), and loading/unloading part (30) and auxiliary loading/unloading part (35) can thus rotate by about a cycle in the lateral direction.



[0046]

Also, because auxiliary loading/unloading part (35) is attached by joining member (6) on loading/unloading part (30), it is possible to remove auxiliary loading/unloading part (35) together with joining member (6) from loading/unloading part (30), and it is possible to attach auxiliary loading/unloading part (35) via joining member (6) on the automatic changer that has carrying auxiliary loading/unloading part (35) not carried on it.

[0047]

Also, movement part (55) of auxiliary loading/unloading part (35) has an appropriate constitution that has second moving part (5b) removed and has second gear (51e) attached in place of first gear (51a). Because many of the members of auxiliary loading/unloading part (35) are shared with those of loading/unloading part (30), it is possible to reduce the manufacturing cost from that of the automatic changer that has the loading/unloading part and the auxiliary loading/unloading part formed monolithically and does not allow removal of the auxiliary loading/unloading part.

[0048]

In the claims, reference symbols are included to facilitate comparison with the figures. However, said symbols included in the claims do not mean that the present invention is restricted to the structure shown in the appended figures.

[0049]

#### Effect of the invention

As explained in detail above, in the automatic changer pertaining to the first invention, said accommodating shelves and said driver are arranged in sector or round shape towards the opening for loading/unloading of said removable recording media at the center; said transporter has the following parts: a rotating shaft arranged at the center position of said sector or round shape, a pair of rotating tables are arranged at a certain distance from each other in the axial direction of said rotating shaft and which are rotated monolithically around said rotating shaft, a pair of rotating shafts arranged in a rotatable way between said rotating tables, a rod shaped guide screw, which has a threaded portion formed on its peripheral surface and which is arranged in a rotatable manner between said two rotating tables, a guide rail arranged parallel with said guide screw between said two rotating tables, a nut engaged to said guide rail, an engagement part engaged with said guide rail, and a holding part that holds said removable recording media; there is a loading/unloading part for loading/unloading said removable recording media; corresponding to rotation of the rotating shaft, said loading/unloading part moves said holding part in the direction perpendicular to the axial direction of said rotating shaft. Consequently, when the rotating tables are rotated, the loading/unloading part, guide screw, and rotating shaft and other parts for transporting said recording media are monolithically rotated with the rotating tables. As a result, they do not interfere with the rotation of the rotating tables, and the loading/unloading part can be rotated by about a cycle around said rotating shaft.

/8

[0050]

The second invention pertains to the automatic changer described in the first invention characterized by the following facts: said transporter also has an auxiliary loading/unloading part having a holding

part that holds said removable recording media; said auxiliary loading/unloading part is attached on said loading/unloading part; corresponding to rotation of said other rotating shaft, it moves said holding part in the direction perpendicular to the longitudinal direction of said rotating shaft. Consequently, it is possible to add an auxiliary loading/unloading part to an automatic changer having only one loading/unloading part, and it is possible to remove the auxiliary loading/unloading part from the automatic changer having the loading/unloading part and auxiliary loading/unloading part. As a result, the auxiliary loading/unloading part can be attached/detached as needed.

[0051]

For the automatic changer pertaining to the third invention, when one rotating shaft rotates, the first gear of the loading/unloading part with its protrusion engaged with the slot on the rotating shaft is rotated, the intermediate gear with one gear part engaged with the first gear is rotated, the crossing gear with one gear part engaged with the other gear part of the intermediate gear is rotated, the guide screw engaged with the other gear of the crossing gear is rotated, and the holding portion where the nut screwed on the guide screw is attached is driven to move along the guide screw. As a result, the holding portion on the side of the loading/unloading part is driven to move in the direction crossing the axial direction of said rotating shaft.

[0052]

On the other hand, when the other rotating shaft rotates, the second gear of the auxiliary loading/unloading part having a protrusion engaged with the slot of the rotating shaft is rotated, the intermediate gear having one gear part engaged with the second gear is rotated, the crossing gear having one gear part engaged with the other gear part of the intermediate gear is rotated, the guide screw

engaged with the other gear of the crossing gear is rotated, and the holding portion where the nut screwed on the guide screw is attached is driven to move along the guide screw. In this way, the holding portion on the auxiliary loading/unloading part is driven to move in the direction crossing the axial direction of said rotating shaft.

[0053]

Consequently, by arranging the intermediate gear at an appropriate position where it can be engaged with either the first gear or the second gear, the loading/unloading part or the auxiliary loading/unloading part can be formed by simply selecting and attaching the first gear or the second gear, a lot of the members of the loading/unloading part and the auxiliary loading/unloading part can be shared, so that the manufacturing cost can be cut.

#### Brief description of the figures

Figure 1 is an oblique view illustrating the constitution of the main portion of the automatic changer pertaining to the present invention.

Figure 2 is a cross-sectional plan view illustrating the constitution of the main portion of the automatic changer in the present invention.

Figure 3 is a side view illustrating the constitution of the transporter.

Figure 4 is a cross-sectional plan view illustrating the constitution of the loading/unloading part.

Figure 5 is a cross-sectional plan view illustrating the constitution of the auxiliary loading/unloading part.

Figure 6 is a plan view illustrating the constitution of the cartridge.

Figure 7 is an oblique view illustrating the overall constitution of the automatic changer in the prior art.

Figure 8 is a cross-section plan view illustrating the automatic changer in the prior art.

Figure 9 is a plan view illustrating the cartridge.

Figure 10 is a schematic diagram illustrating the operation of the automatic changer in the present invention.

#### Explanation of symbols

1	Automatic changer
1a	Automatic changer
2	Accommodating shelf
20	Storage chamber
3	Transporter
30	Loading/unloading part
31	Holding part
32	Case
33	Guide screw
33a	Nut
34	Hook portion
35	Auxiliary loading/unloading part
36	Holding part
37	Case
38	Guide screw
38a	Nut

39	Hook portion
4	Rotating table
41	Rotating shaft
5	Moving part
5a	First moving part
5b	Second moving part
51A, 51B	Rotating shaft
51a	First gear
51b	Intermediate gear
51c	Crossing gear
51d	Last gear
51e	Second gear
51f	Intermediate gear
51g	Crossing gear
51h	Last gear
52	Guide screw
52a	Nut
53	Guide rail
9	Cartridge
D	Driver

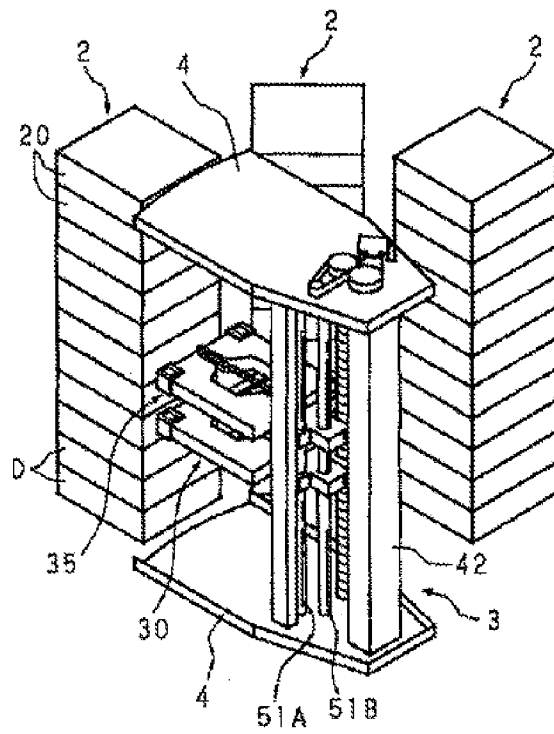


Figure 1

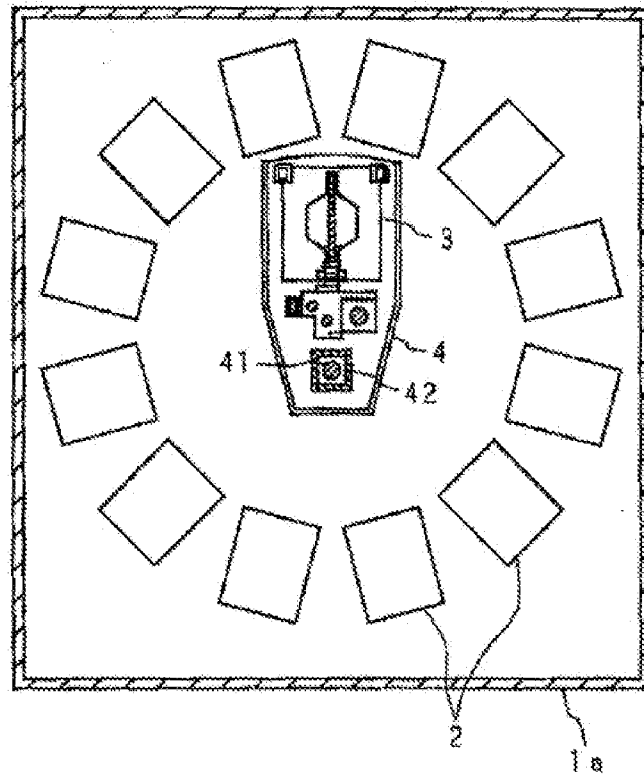


Figure 2

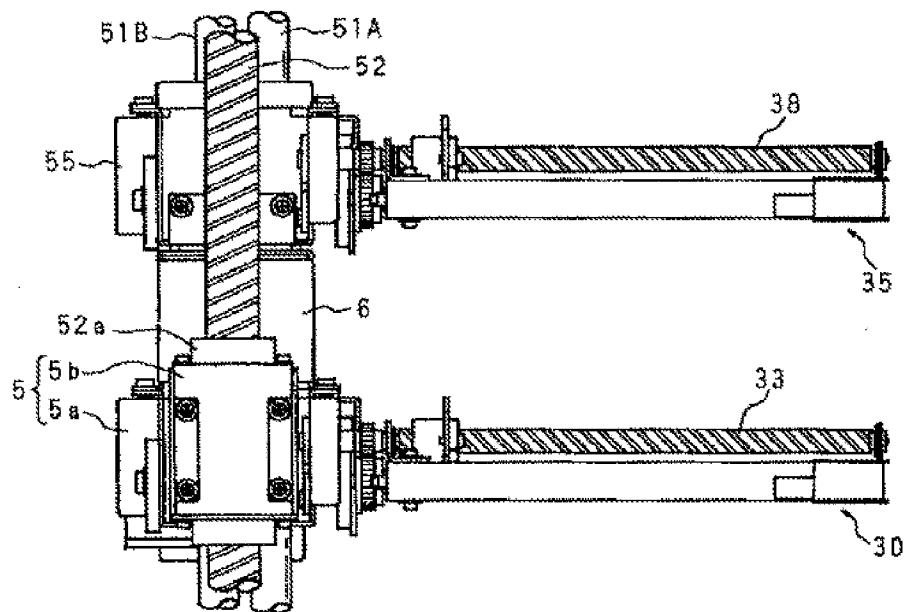


Figure 3



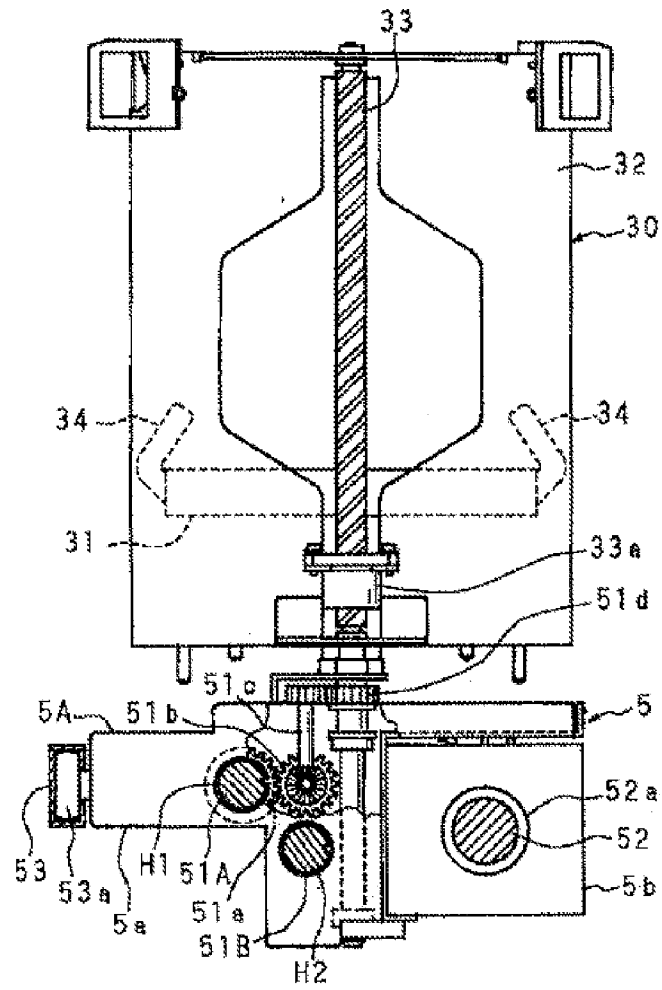


Figure 4

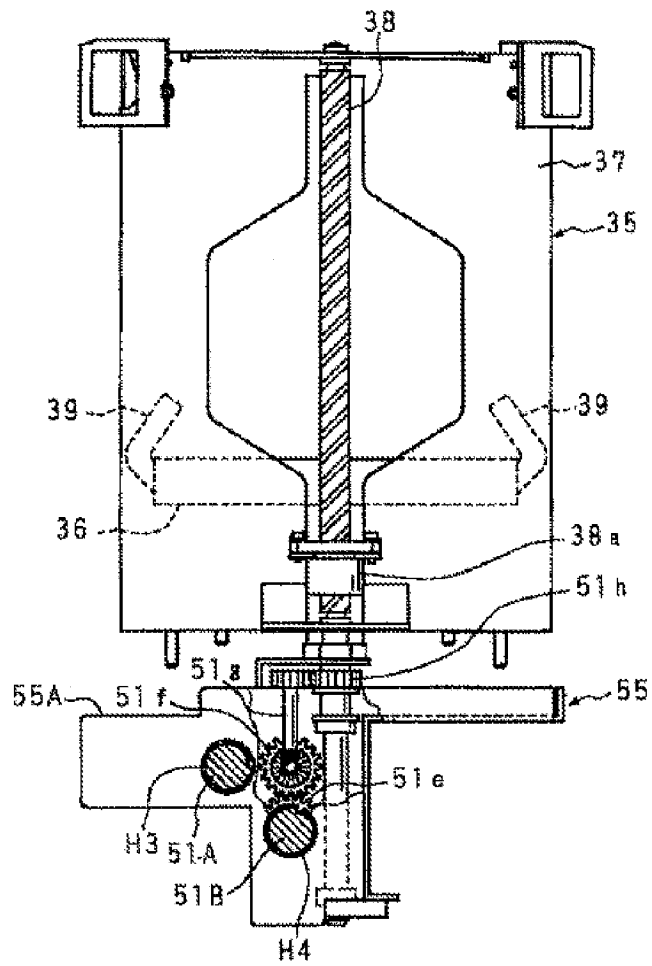


Figure 5

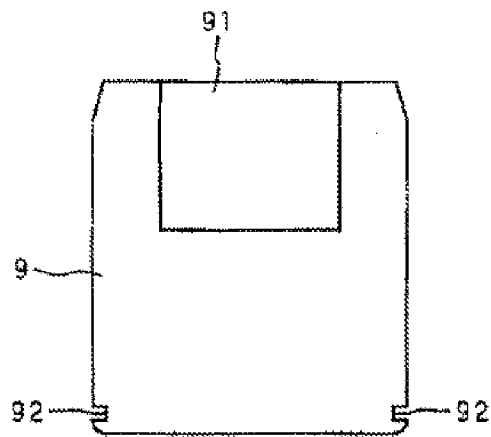


Figure 6

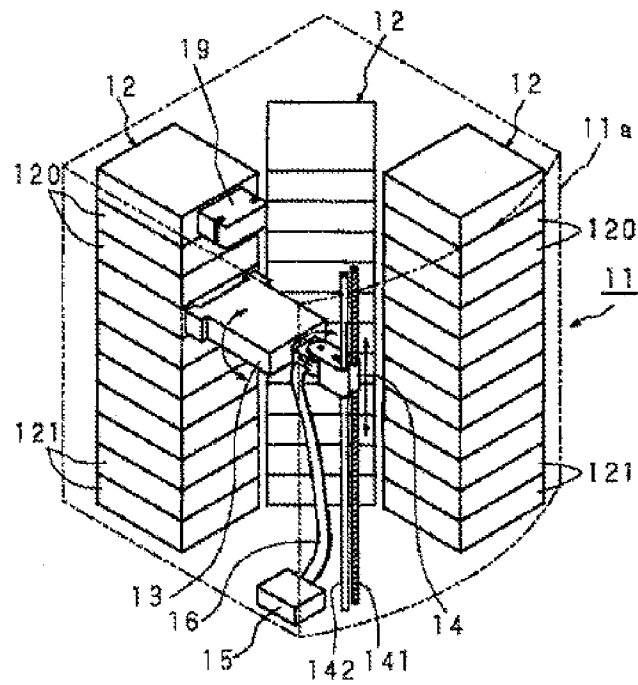


Figure 7

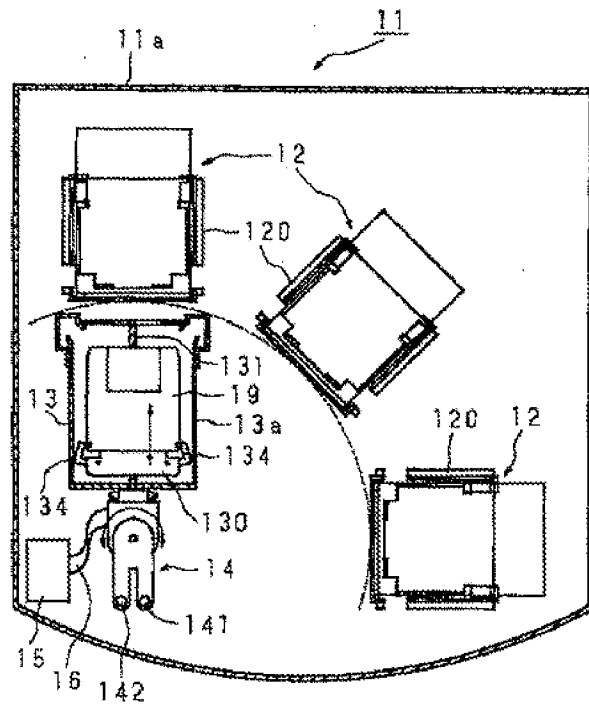


Figure 8

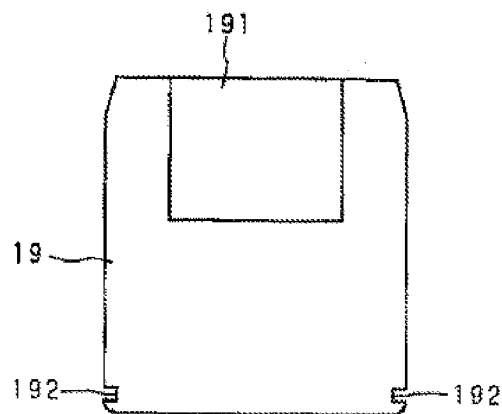


Figure 9

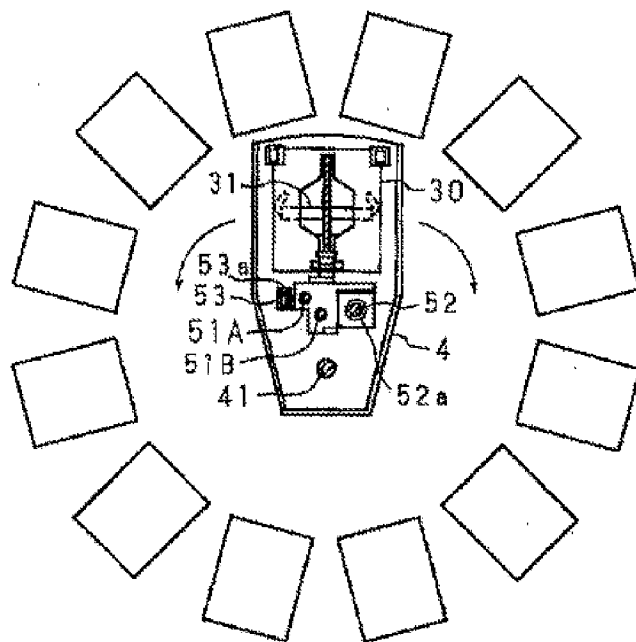


Figure 10